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EXAMINER	
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ART UNIT	PAPER NUMBER
2874	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/759,858	BLAUVELT ET AL.	
	Examiner	Art Unit	
	Michelle R. Connelly-Cushwa	2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-86 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) 21-24,34-43,64-67 and 77-86 is/are allowed.

6)☒ Claim(s) 1-4,7-10,13,14,17,19,20,25-31,33,44-50,53,56,57,61,68-74 and 76 is/are rejected.

7)☒ Claim(s) 5,6,11,12,15,16,18,32,51,52,54,55,58-60,62,63 and 75 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 10 May 2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

One (1) replacement sheet of drawings was received on May 10, 2004 and has been accepted by the Examiner.

Twenty-seven (27) sheets of drawings were filed on January 16, 2004 and have been accepted by the Examiner.

Specification

Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

Claim 9 is objected to because of the following informalities:

Regarding claim 9, "claim 1B" in line 1 of claim 9 should be changed to –claim 1-.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 7, 8, 10, 19, 44, 46-49, 53 and 61 are rejected under 35 U.S.C. 102(b) as being anticipated by Hara et al. (JP 62-269907).

Regarding claims 1-4, 10 and 19; Hara et al. discloses an optical apparatus in Figure 5(a), comprising :

- a semiconductor device substrate (301);
- a semiconductor optical device formed on the device substrate and including a device waveguide segment (302) terminating at a device end face; and
- an end-coupled planar optical waveguide (307) formed on the device substrate (301) at the device end face and end-coupled at its proximal end to the device waveguide through the device end face, the end-coupled waveguide including a waveguide core (307) and a waveguide cladding (306);
- wherein a proximal portion of the end coupled waveguide includes a) waveguide cladding material between the device end face and a proximal end of the waveguide core, and b) waveguide core material on the device end face extending upward from the waveguide core away from the substrate;
- wherein the waveguide cladding material between the device end face and the proximal end of the waveguide core results in a proximal segment of the end-coupled waveguide lacking substantially complete transverse optical confinement;
- wherein the waveguide cladding material between the device end face and the proximal end of the waveguide core forms a multimode waveguide segment;

- wherein the end-coupled waveguide comprises a low-index planar optical waveguide; and
- wherein the end-coupled waveguide functions as a transverse-mode expander.

Regarding claims 7 and 8;

- the proximal portion of the end-coupled waveguide (307) includes a waveguide core material (307) on the device end-face extending upward from the waveguide core away from the substrate (301);
- the proximal portion of the end-coupled waveguide includes waveguide cladding material (306) between the device end face and the upwardly-extending waveguide core material (307); and
- the thickness of the waveguide cladding material (306) between the device end face and the upwardly-extending waveguide core material is chosen to alter an effective reflectivity of the end face.

Regarding claims 44, 46 and 47; Figure 5(a) of Hara et al. discloses a method comprising:

- forming a semiconductor optical device on a device substrate (301), the optical device including a device waveguide segment (302) terminating at a device end face;
- depositing waveguide cladding material (306) on the substrate and the device end face so that the cladding material substantially covers the device end face and forms a waveguide lower cladding layer;

- depositing waveguide core material over the lower cladding layer so as to form a waveguide core (307), deposited waveguide core material extending upward from a proximal end of the waveguide core away from the substrate; and
- depositing waveguide cladding material (306) over the waveguide core material and lower cladding layer so as to form a waveguide upper cladding layer;
- wherein the lower cladding layer, the waveguide core, and the upper cladding layer form an end-coupled planar optical waveguide on the device substrate end-coupled at its proximal end to the device waveguide through the device end-face;
- wherein the proximal portion of the end-coupled waveguide includes waveguide cladding material (306) between the device end face and the proximal end of the waveguide core (307);
- and wherein the method further comprises forming a multimode waveguide segment from the cladding material between the device end face and the proximal end of the waveguide core.

Regarding claims 48 and 49;

- the proximal portion of the end-coupled waveguide includes waveguide cladding material (306) between the device end face and the upwardly-extending waveguide core material (307); and

- the thickness of the waveguide cladding material between the device end face and the upwardly-extending waveguide core material is chosen to alter an effective reflectively of the device end face;
- wherein the proximal portion of the end-coupled waveguide includes waveguide core material on the device end face extending upward from the proximal end of the waveguide core away from the substrate.

Regarding claims 53 and 61; the end-coupled waveguide comprises a low-index planar optical waveguide and the end-coupled waveguide functions as a transverse-mode expander.

Claims 1-4, 7, 8, 10 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Tien (US 3,948,583).

Regarding claims 1-4 and 10; Tien discloses an optical apparatus in Figures 1 and 5, comprising :

- a semiconductor device substrate (30);
- a semiconductor optical device formed on the device substrate and including a device waveguide segment (34) terminating at a device end face (34' in Figure 1, 74' in Figure 5); and
- an end-coupled planar optical waveguide (75, See Figure 5) formed on the device substrate at the device end face (74') and end-coupled at its proximal end to the device waveguide through the device end face, the end-coupled waveguide including a waveguide core (75) and a waveguide cladding (71);

- wherein a proximal portion of the end coupled waveguide includes a) waveguide cladding material (71) between the device end face (74') and a proximal end of the waveguide core, and b) waveguide core material (75) on the device end face (74') extending upward from the waveguide core away from the substrate;
- wherein the waveguide cladding material between the device end face and the proximal end of the waveguide core results in a proximal segment of the end-coupled waveguide lacking substantially complete transverse optical confinement;
- wherein the waveguide cladding material between the device end face and the proximal end of the waveguide core forms a multimode waveguide segment; and
- wherein the end-coupled waveguide comprises a low-index planar optical waveguide.

Regarding claims 7 and 8;

- the proximal portion of the end-coupled waveguide (75) includes a waveguide core material (75) extending upward from the waveguide core away from the substrate;
- the proximal portion of the end-coupled waveguide includes waveguide cladding material (71) between the device end face (74') and the upwardly-extending waveguide core material; and

- the thickness of the waveguide cladding material (71) between the device end face and the upwardly-extending waveguide core material is chosen to alter an effective reflectivity of the end face.

Regarding claim 17; the device end-face (34' in Figure 1 and 74' in Figure 5) is non-normal with respect to optical propagation along the device waveguide segment (34).

Claims 25, 26, 28-30, 33, 68, 69, 71-73 and 76 are rejected under 35 U.S.C. 102(b) as being anticipated by Westwood et al. (US 4,969,712).

Regarding claims 25 and 30; Westwood et al. discloses an optical apparatus comprising:

- a semiconductor device substrate (110);
- a semiconductor optical device (120) formed on the device substrate and including a device waveguide segment (124) terminating at a device end face;
- an end-coupled planar optical waveguide (130) formed on the device substrate (110) at the device end face and end-coupled at its proximal end to the device waveguide through the device end face, the end-coupled waveguide including a core (132/136) and waveguide cladding (131, 138); and
- a second optical waveguide either optically end-coupled (160, See Figure 1) with the end-coupled planar optical waveguide at a distal end

thereof or optically transverse-coupled (160, See Figure 4) with the end-coupled planar optical waveguide.

Regarding claim 26; the second optical waveguide is an optical fiber (160) mounted on the device substrate (110).

Regarding claim 28; the end-coupled waveguide functions as a transverse mode expander.

Regarding claims 29 and 33; the end-coupled waveguide comprises a low-index planar optical waveguide.

Regarding claims 68, 69 and 73; Westwood et al. discloses a method in Figures 1 and 4, comprising:

- forming a semiconductor optical device (120) on a device substrate (110), the optical device including a device waveguide segment (124) terminating at a device end face;
- depositing waveguide cladding material on the substrate so as to form a waveguide lower cladding layer (131);
- depositing waveguide core material over the lower cladding layer so as to form a waveguide core (132/136);
- depositing waveguide cladding material over the waveguide core material and the lower cladding material so as to form a waveguide upper cladding layer (138), thereby forming an end-coupled planar optical waveguide on the device substrate end-coupled as its proximal end to the device waveguide through the device end face, the end-

coupled waveguide comprising the lower cladding layer, waveguide core, and the upper cladding layer; and

- optically end-coupling a second optical waveguide (160) with the end-coupled planar optical waveguide at a distal end thereof (see Figure 1), or optically transverse-coupling a second optical waveguide (160) with the end-coupled planar optical waveguide (see Figure 4);
- wherein the second optical waveguide (160) comprises an optical fiber and the fiber is mounted on the device substrate (110).

Regarding claim 71; the end-coupled waveguide functions as a transverse mode expander.

Regarding claims 72 and 76; the end-coupled waveguide comprises a low-index planar optical waveguide.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 9, 45 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hara et al. (JP 62-269907).

Regarding claim 9; Hara et al. discloses all of the limitations of claim 9 as applied above, except for specifically stating that the waveguide segment lacking substantially complete optical confinement is less than about 1 micrometer long. It would have been

obvious to one of ordinary skill in the art to have the waveguide segment lacking substantially complete optical confinement be less that about 1 micrometer long, since where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges (*In re Aller*, 105 USPQ 233) and/or discovering an optimum value of a result effective variable involves only routine skill in the art (*In re Boesch*, 617 F.2d 272,205 USPQ 215 (CCPA 1980)).

Regarding claim 45; Hara et al. discloses all of the limitations of claim 45 as applied above, except for multiple optical devices being formed concurrently on a common device substrate wafer, and multiple corresponding end-coupled waveguides being formed concurrently on the common substrate wafer, and further comprising dividing the common substrate wafer into multiple device substrates. It is common practice in the art to batch process multiple optical devices by forming the multiple devices and any integrated waveguides on a common device substrate wafer simultaneously and then dividing the common substrate wafer into multiple device substrates having a single device and corresponding integrated waveguide thereon to decrease manufacturing costs and increase the speed with which such optical devices are manufactured. Therefore, one of ordinary skill in the art would have found it obvious to form multiple optical devices concurrently on a common device substrate wafer, and multiple corresponding end-coupled waveguides concurrently on the common substrate wafer, and divide the common substrate wafer into multiple device substrates to reduce manufacturing costs and decrease production time.

Regarding claim 50; the waveguide core material on the device end face results in a proximal segment of the end-coupled waveguide lacking complete transverse optical confinement in the invention of Hara et al. Hara et al. discloses all of the limitations of claim 50 as applied above, except for specifically stating that the waveguide segment lacking substantially complete optical confinement is less than about 1 micrometer long. It would have been obvious to one of ordinary skill in the art to have the waveguide segment lacking substantially complete optical confinement be less that about 1 micrometer long, since where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges (*In re Aller*, 105 USPQ 233) and/or discovering an optimum value of a result effective variable involves only routine skill in the art (*In re Boesch*, 617 F.2d 272,205 USPQ 215 (CCPA 1980)).

Claims 13, 14, 25-30, 33, 56 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hara et al. (JP 62-269907) in view of Westwood et al. (4,969,712).

Regarding claims 13, 25, 28, 29 and 56; Hara et al. discloses all of the limitations of claims 13, 25, 28, 29 and 56 as applied above, except for specifically stating that a second optical waveguide is optically end-coupled with the end-coupled planar optical waveguide at a distal end thereof. Semiconductor devices including active waveguide segments (302), as disclosed in Hara et al., are well known and commonly used to transmit optical signals into end-coupled planar optical waveguides that are further end-coupled to a second optical waveguide at a distal end thereof in order to further transmit the optical signal in an optical network. Westwood et al. discloses an optical

semiconductor device having a waveguide layer (124) end-coupled to the proximal end of a planar waveguide (132/136) that is further end-coupled at a distal end to a second optical waveguide (162) to further transmit the optical signal (see Figure 1). Therefore, one of ordinary skill in the art would have found it obvious to incorporate a second optical waveguide that is optically end-coupled with the end-coupled planar optical waveguide at a distal end there-of to further transmit an optical signal in the invention of Hara et al., since this arrangement is known in the art.

Regarding claims 14, 30, 33 and 57; Hara et al. discloses all of the limitations of claims 14, 30, 33 and 57 as applied above, except for specifically stating that a second optical waveguide is optically transverse-coupled with the end-coupled planar optical waveguide. Semiconductor devices including active waveguide segments (302), as disclosed in Hara et al., are well known and commonly used to transmit optical signals into end-coupled planar optical waveguides that are further end-coupled to a second optical waveguide at a distal end thereof in order to further transmit the optical signal in an optical network. Westwood et al. discloses an optical semiconductor device having a waveguide layer (124) end-coupled to the proximal end of a planar waveguide (132/136) that is further optically transverse-coupled at a distal end to a second optical waveguide (162) to further transmit the optical signal (see Figure 4). Therefore, one of ordinary skill in the art would have found it obvious to incorporate a second optical waveguide that is optically transverse-coupled with the end-coupled planar optical waveguide at a distal end there-of to further transmit an optical signal in the invention of Hara et al. since this arrangement is known in the art.

Regarding claim 26; Westwood et al. teaches that the second optical waveguide is an optical fiber (160) mounted on the device substrate (110).

Regarding claim 27; the combination of Hara et al. and Westwood et al. teaches all of the limitations of claim 27 as applied above, except for specifically stating that the second optical waveguide comprises a planar optical waveguide formed on a waveguide substrate with the device mounted on the waveguide substrate. It would have been obvious to one of ordinary skill in the art to have the second optical waveguide comprise a planar optical waveguide, since planar optical waveguides are known alternatives for optical fibers in optical communication systems. Furthermore, planar optical waveguides are formed on substrates and it is common practice in the art to mount devices on the waveguide substrates to couple the devices to the waveguides. Thus, to mount the device on a planar waveguide substrate to further couple the end-coupled waveguide to a second planar waveguide is within the level or ordinary skill in the art.

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tien (US 3,948,583).

Regarding claim 20; The device disclosed in Figure 1 of Tien includes a second device waveguide segment of the semiconductor optical device terminating at a second device end face (34' at the opposite end). Tien does not specifically disclose a second end-coupled planar optical waveguide formed on the device substrate at the second device end face and end-coupled at its proximal end to the device waveguide through the second device end face. Tien, however, does teach that the light is coupled out of

the cavity formed by the end faces of the device waveguide as shown in Figure 5. Therefore, to couple light out of either one or both the first or second end-faces of the semiconductor optical device disclosed in Figure 1 of Tien by providing either a first or a first and a second planar optical waveguide, respectively coupled to the first and second end-faces, would not involve an inventive step. Thus, one of ordinary skill in the art would have found it obvious to incorporate a second planar optical waveguide formed on the device substrate as illustrated in Figure 5 and end-coupled at its proximal end to the device waveguide through the second device end face, the second end-coupled waveguide including a core and a cladding and also including waveguide cladding material (71) between the device end face (74') and a proximal end of the waveguide core, and waveguide core material (75) on the device end face (74') extending upward from the waveguide core away from the substrate.

Claims 27, 31, 70, 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Westwood et al. (US 4,969,712).

Regarding claims 27, 31, 70, 74; Westwood et al. teaches all of the limitations of these claims as applied above, except for specifically stating that the second optical waveguide comprises a planar optical waveguide formed on a waveguide substrate with the device mounted on the waveguide substrate. It would have been obvious to one of ordinary skill in the art to have the second optical waveguide comprising a planar optical waveguide, since planar optical waveguides are known alternatives for optical fibers in optical communication systems. Furthermore, planar optical waveguides are formed on substrates and it is common practice in the art to mount devices on the waveguide

substrates to couple the devices to the waveguides. Thus, to mount the device on a planar waveguide substrate to further couple the end-coupled waveguide to a second planar waveguide is within the level of ordinary skill in the art.

Allowable Subject Matter

Claims 5, 6, 11, 12, 15, 16, 18, 32, 51, 52, 54, 55, 58-60, 62, 63 and 75 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 21-24, 34-43, 64-67 and 77-86 are allowed.

The following is a statement of reasons for the indication of allowable subject matter: The prior art cited on attached form PTO-892 is the most relevant prior art known, however, the invention of claims 5, 6, 11, 12, 15, 16, 18, 21-24, 32, 34-43, 51, 52, 54, 55, 58-60, 62-67, 75 and 77-86 distinguishes over the prior art of record for the following reasons.

Regarding claim 5; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious an apparatus as defined in claim 5, wherein the waveguide core supports an optical mode substantially spatial-mode-matched with an optical mode supported by the device waveguide segment and the length of the multimode waveguide segment is chosen so as to result in substantially spatial-mode-matched end-coupling between the device waveguide segment and the portion of the end-coupled waveguide that includes the

waveguide core in combination with the limitations of the base and any intervening claims.

Regarding claim 6; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious an apparatus as defined in claim 6, wherein the waveguide core supports an optical mode larger than an optical mode supported by the device waveguide segment, and the length of the multimode waveguide segment is chosen so that it functions as a mode expander for end-coupling the device waveguide segment and the end-coupled waveguide in combination with the limitations of the base and any intervening claims.

Regarding claim 11; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious an apparatus as defined in claim 11, further comprising a reflective coating formed between the device substrate and at least a portion of the end-coupled waveguide in combination with the limitations of the base and intervening claims.

Regarding claim 12; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious an apparatus as defined in claim 12, further comprising an optical coating formed between the device end face and the end-coupled waveguide in combination with the limitations of the base and any intervening claims.

Regarding claim 15; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious an

apparatus as defined in claim 15, wherein the end-coupled waveguide includes a dual-core segment in combination with the limitations of the base and any intervening claims.

Regarding claim 16; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious an apparatus as defined in claim 16, wherein at least a portion of the device end face is curved in at least one dimension in combination with the limitations of the base and any intervening claims.

Regarding claim 18; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious an apparatus as defined in claim 18, wherein the device end face includes an outwardly protruding portion extending along the substrate from a bottom portion of the device end face beneath a proximal portion of the end-coupled waveguide; and at least one layer of the end-coupled waveguide decreases in thickness toward the end face, the outwardly protruding portion of the device waveguide and the decreasing layer thickness together yielding a desired layer surface profile for at least one layer of the end-coupled waveguide in combination with the limitations of the base and any intervening claims.

Regarding claims 21-24; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious an apparatus as defined in claim 21, comprising a reflective coating formed between the device substrate and at least a portion of the end-coupled waveguide in combination with the other limitations of claim 21. Claims 22-24 depend from claim 21.

Regarding claim 32; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious an apparatus as defined in claim 32, wherein transverse-coupling between the end-coupled waveguide and the second waveguide is substantially adiabatic transverse-coupling in combination with the limitations of the base and any intervening claims.

Regarding claims 34-39; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious an apparatus as defined in claim 34, wherein at least a portion of the device end face is curved in at least one dimension in combination with the other limitations of claim 34. Claims 35-39 depend from claim 34.

Regarding claims 40-43; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious an apparatus as defined in claim 40, wherein the device end face includes an outwardly protruding portion extending along the substrate from a bottom portion of the device end face beneath a proximal portion of the end-coupled waveguide; and at least one layer of the end-coupled waveguide decreases in thickness toward the end face, the outwardly protruding portion of the device waveguide and the decreasing layer thickness together yielding a desired layer surface profile for at least one layer of the end-coupled waveguide in combination with the other limitations of claim 40. Claims 41-43 depend from claim 40.

Regarding claim 51; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a

method as defined in claim 51, further comprising, before depositing the waveguide core material, masking the lower cladding layer, leaving unmasked that portion of the waveguide cladding material covering the device end face, forming a substantially flat upper surface of the lower cladding layer and exposing an upper portion of the device end face by removing the unmasked portion of the waveguide cladding material until is about the same thickness as the lower cladding layer and thereby forms a portion thereof, and de-masking the lower cladding layer, wherein the upward-extending waveguide core material at the proximal end of the waveguide core is deposited on the exposed upper portion of the device end face in combination with the limitations of the base and any intervening claims.

Regarding claim 52; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 52, wherein waveguide cladding material deposited on the device substrate and on the device end face is at least as thick as the device waveguide segment, and further comprising, before depositing waveguide core material, forming a substantially flat waveguide cladding material upper surface substantially flush with an upper surface of the device waveguide segment by removing waveguide cladding material by chemical-mechanical polishing, and forming a substantially flat lower cladding layer and exposing an upper portion of the device end face by removing waveguide cladding material by cladding-material-specific etching, wherein the upward-extending waveguide core material at the proximal end of the waveguide core is

deposited on the exposed upper portion of the device end face in combination with the limitations of the base and any intervening claims.

Regarding claim 54; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 54, further comprising forming a reflective coating between the device substrate and at least a portion of the end-coupled waveguide in combination with the limitations of the base and any intervening claims.

Regarding claim 55; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 55, further comprising forming an optical coating between the device end face and the end-coupled waveguide in combination with the limitations of the base and any intervening claims.

Regarding claim 58; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 58, wherein the end-coupled waveguide includes a dual-core segment in combination with the limitations of the base and any intervening claims.

Regarding claim 59; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 59, wherein at least a portion of the device end face is curved in at least one dimension in combination with the limitations of the base and any intervening claims.

Regarding claim 60; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 60, wherein the device end face is non-normal with respect to optical propagation along the device waveguide segment in combination with the limitations of the base and any intervening claims.

Regarding claim 62; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 62, wherein the device end face includes an outwardly protruding portion extending along the substrate from a bottom portion of the device end face beneath a proximal portion of the end-coupled waveguide, and at least one layer of the end-coupled waveguide decreases in thickness toward the end face, the outwardly protruding portion of the device waveguide and the decreasing layer thickness together yielding a desired layer surface profile for at least one layer of the end coupled waveguide in combination with the limitations of the base and any intervening claims.

Regarding claim 63; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 63, further comprising forming for the semiconductor optical device a second device waveguide segment terminating at a second device end face, depositing waveguide cladding material on the substrate and the second device end face so that the cladding material substantially covers the device end face and forms a second waveguide lower cladding layer; depositing waveguide core material over the second lower cladding layer so as to form a second waveguide core, deposited

waveguide core material extending upward form a proximal end of the second waveguide core away form the substrate, and depositing waveguide cladding material over the waveguide core material and second lower cladding layer so as to form a second waveguide upper cladding layer, wherein the second lower cladding layer, second waveguide core, and second upper cladding layer form a second end-coupled planar optical waveguide on the device substrate end-coupled at its proximal end to the device waveguide through the second device end face in combination with the limitations of the base and any intervening claims.

Regarding claims 64-67; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 64, comprising forming a reflective coating between the device substrate and at least a portion of the end-coupled waveguide in combination with the other limitations of claim 64. Claims 65-67 depend from claim 64.

Regarding claim 75; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 75, further comprising adapting at least one of the end-coupled waveguide and the second waveguide for substantially adiabatic transverse-coupling therebetween in combination with the limitations of the base and any intervening claims.

Regarding claims 77-82; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 77, wherein at least a portion of the device end

face is curved in at least one dimension in combination with the other limitations of claim 77. Claims 78-82 depend from claim 77.

Regarding claims 83-86; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 83, wherein the device end face includes an outwardly protruding portion extending along the substrate from a bottom portion of the device end face beneath a proximal portion of the end-coupled waveguide, and at least one layer of the end-coupled waveguide decreases in thickness toward the end face, the outwardly protruding of the device waveguide and the decreasing layer thickness together yielding a desired layer surface profile for at least one layer of the end-coupled waveguide in combination with the other limitations of claim 83. Claims 84-86 depend from claim 83.

Hence, there is no reason or motivation for one of ordinary skill in the art to use the prior art of record to make the invention of claims 5, 6, 11, 12, 15, 16, 18, 21-24, 32, 34-43, 51, 52, 54, 55, 58-60, 62-67, 75 and 77-86.

Conclusion

Any inquiry concerning the merits of this communication should be directed to Examiner Michelle R. Connelly-Cushwa at telephone number (571) 272-2345. The examiner can normally be reached 9:00 AM to 7:00 PM, Monday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney B. Bovernick can be reached on (571) 272-2344. The fax phone

number for the organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general or clerical nature should be directed to the Technology Center 2800 receptionist at telephone number (571) 272-1562.

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Patent Examiner
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